THE OPEN UNIVERSITY OF SRI LANKA

Faculty of Engineering Technology

Department of Mathematics and Philosophy of Engineering

Continuous Assessment Test I (2014\2015)

Diploma in Technology (Level 3)

MPZ3231-Engineering Mathematics IA

Duration: One and Quarter ($1\frac{1}{4}$)Hours **RegistrationNumber** : .....

Date: 20^{th} January 2015 Time: 1545 hrs -1700 hrs

Instructions

- **Answer All Questions**
- **Number of pages in the paper - 07.**
- **All symbols are in standard notation.**

1. The position vectors P, Q, R and S with reference to an origin O are $\mathbf{i}+5\mathbf{j}+4\mathbf{k}, -\mathbf{i}+\lambda\mathbf{j}, 4\mathbf{i}+9\mathbf{j}+3\mathbf{k}$ and $-3\mathbf{i}+4\mathbf{j}-4\mathbf{k}$ respectively. Where λ is a parameter.

   (a) Find $\overrightarrow{PQ}$ and $\overrightarrow{PS}$. [10%]

(b) Determine the value of λ such that P, Q, S are collinear. [20%]

(c) Find $\overrightarrow{PQ} \times \overrightarrow{PR}$ in terms of λ. [20%]

(d) Find $\overrightarrow{PQ} \times \overrightarrow{PR}.\overrightarrow{PS}$in terms of λ. [20%]

(e) By using the result of (d), show that when the points P, Q, R are non collinear, The points p, Q, R, S are non collinear. [30%]

2. The position vectors of the points A, B, C are $2i + j - 2k, 4i - j - k, 3i + 3j$ respectively with respect to an origin O.

   (a) Find $\overrightarrow{OA}.\overrightarrow{AB}$ and $\overrightarrow{OA}.\overrightarrow{AC}$. [20%]

   (b) Find an unit vector perpendicular to the plane ABC. [20%]

   (c) Find $OB.OC$. [10%]

   (d) Find the angle $B\hat{O}C$. [10%]

(e) Find $\overrightarrow{AB} \times \overrightarrow{AC}$. [20%]

(f) Find the area of the triangle ABC. [20%]

3. (a) Without expanding the determinants, Prove that

i. $\begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix} = 0$

ii. $\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix} = x^3$ [40%]

(b) Consider the system

$$4x + ay = 16$$

$$2ax + 18y = b$$

i. For which values of a, does the system has an unique solution? [30%]

ii. Find those pairs of values (a,b) for which the system has an infinite number of solutions. [40%]

End